Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

BACHELOR THESIS

How to Identify Domestic Systematicaly Important Institutions (D-SIFI)

Author: **Matěj Melichar**

Supervisor: **PhDr. Jakub Seidler, Ph.D.**

Academic Year: **2013/2014**

Declaration of Authorship

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

The author grants to Charles University permission to reproduce and to distribute copies of this thesis document in whole or in part.

Prague, July 30, 2014

Signature

Acknowledgments

I would like to express my gratitude to Jakub Seidler for his guidance and encouragement.

Abstract

The 2007 financial crisis has highlighted the problem of so-called "too-big-to-fail" financial institutions. These institutions are so large, interconnected and complex that their failure can cause significant distress in the financial system or even trigger a systemic crisis. In order to address the systemic risk posed by these institutions it is first necessary to identify them. BCBS has proposed a methodology to assess the systemic importance of global banks. This paper presents a methodology for identification of Czech domestic systemically important banks. The method is based on balance sheet indicators of banks. The assessment is using the data for years 2008-2012 and identifies four banks as systemically important for the Czech banking sector.

Keywords	Systemic importance, systemically important banks, SIFI

Author's e-mail	matej.melichar@seznam.cz
Supervisor's e-mail	seidler@fsv.cuni.cz

Abstrakt

Finanční krize v roce 2007 zvýraznila problematiku takzvaných “too-big-to-fail” finančních institucí. Tyto instituce jsou tak velké, navzájem propojené a komplexní, že jejich pád může způsobit značnou tíseň ve finančním systému nebo dokonce zapříčinit systémovou krizi. Aby mohlo být systémové riziko způsobené těmito institucemi adresováno je nejprve nutné je identifikovat. BCBS navrhla metodologii k posouzení systémové důležitosti globálních bank. Tato práce představuje metodologii identifikace českých systematicky důležitých bank. Metoda je založena na indikátorech z bankovních rozvah. Na základě dat z let 2008-2012 jsou identifikovány čtyři české banky jako systematicky důležité pro domácí bankovní sektor.

Klíčová slova Systémová důležitost, systémově důležité banky, SIFI

E-mail autora matej.melichar@seznam.cz
E-mail vedoucího práce seidler@fsv.cuni.cz

Contents

List of Tables

List of Figures

Acronyms

BCBS Basel Committee on Banking Supervision

BIS Bank for International Settlements

ČNB Česká Národní Banka / Czech National Bank

ČSOB Československá Obchodní Banka

D-SIB Domestic Systemically Important Bank

FSB Financial Stability Board

G-SIB Global Systemically Important Bank

IMF International Monetary Fund

SIB Systemically Important Bank

SIFI Systemically Important Financial Institution

Bachelor Thesis Proposal

The thesis will deal with the problematics of Domestic Systemically Important Financial Institutions. These institutions are often perceived as „too big to fail“ meaning that their failure would have large negative impact on the financial system and the whole economy, and therefore public sector‘s regulation and help in difficulties is needed.

The goal of the thesis is to set up a methodology for assessment of systemical importance of financial institutions in domestic environment. The methodology will be based on indicator-based measurement approach as proposed by the Basel Committee (BCBS, 2011). Indicators will take into account the size of the finacial institutions, their interconectedness, complexity, and amount of available substitutes for the services that they provide. The method will be applied on Czech Republic.

REFERENCES:

BCBS (2011). „Global systemically important banks: Assessment methodology and the additional loss absorbency requirement“. BIS.

Brämer, P., Gischer, H. (2011): “Domestic Systemically Important Banks: An Indicator-Based Measurement Approach for the Australian Banking System“, FEMM Working Paper No.3/2012, Otto-von-Guericke University of Magdeburg.

Skořepa, M. and Seidler, J. (2013): “An Additional Capital Requirement Based on the Domestic Systemic Importance of a Bank.” Financial Stability Report 2012/2013, Czech National Bank, pp. 96–102

1 Introduction

After the financial crisis in 2007 a problem of so called “too-big-to-fail“ financial institutions has arised. These institutions are believed to be so large, complex and interconnected that their collapse might have disastrous consequences for the rest of the financial system. The damage caused by their collapse could be so big that the government would need to intervene and help these institutions in order to preserve the functionality and confidence in the financial system. The main problem that arises with this approach is moral hazard for the decision makers in systematically important financial institutions (SIFIs). More risk is taken in order to make higher profits with the assumption that the government policy would protect the institution in case of trouble. This leads to outcomes that are not optimal from systemic point of view. In order for this externality to be corrected by e.g. regulation, it is first necessary to be able to identify which institutions are systemically important.

In 2011 Basel Comittee on Banking Supervision (BCBS) has published an asessment methodology to identify global systemically important banks (G-SIB) and also proposed additional regulatory measures for these institutions. In 2012 another document was released, concerning the identification of domestic systematically important banks (D-SIB) and their regulation on the level of countries. This document sets the rules for the identification of systemically important banks more loosely than the first one and serves as a guideline for the domestic regulatory authority to set the precise rules and measures.

The objective of this thesis is to propose a methodology for identification of D-SIBs in Czech Republic based on the BCBS framework and works of other researchers. The methodology will be then applied on Czech banks.

In section 2 is the theoretical background for the problematic summarized. The notion of systemic importance and the methods for identifying the systemically important banks are described. Then the topic of domestic systemically important banks as described by the BCBS is presented. Section 3 illustrates characteristics of Czech banking system. Section 4 proposes the assessment methodology for identifying Czech systemically important banks. The BCBS approach is summarized and adjusted for the needs of measurement in domestic environment and the calculation method is introduced. Section 5 presents the results of the quantitave analysis i.e. the distribution of systemic risk in Czech banking system and its time trends. The problem of data availability and the validity of the calculated results is discussed. Section 6 concludes.

2 Theoretical background

2.1 Systemic importance

One of the main goals of central banks besides monetary policy is to maintain financial stability. To achieve financial stability central banks need to promote time-consistent incentives for the financial firms and other involved institutions. To set these incentives right the supervisors need to deal with systemic risk and mainly with systemically important institutions. The establishment of a financial stability supervisor alone is not enough to achieve stability, there is a need to deal with systemically important institutions proactively. To do this, it is necessary to have a definition of systemically important institution. (Thomson 2009)

Is not very straightforward to define a systemically important financial institution due to varying regulations, conditions and level of development of different financial markets. From the microprudential point of view it can be defined as an institution whose failure would cause large losses to its creditors and shareholders in the form of direct costs. From macroprudential point of view, a systemically important institution is part of a system whose failure would cause large distress to its surroundings and would threaten the smooth functioning of the whole financial system. This factor is more important as the impacts of failure of such an institution have the potentional to trigger systemic crisis. This is the negative point of view - a SIFI can be defined as an institution whose failure could cause significant damage to the whole financial system. On the other hand, from positive point of view it can be seen as an institution whose activities and services are crucial for the efficient and smooth functioning of the financial system and the real economy and therefore its survival is essential. (Komárková, Z., Hausenblas, V., Frait, J., 2012)

For the purpose of regulatory policy it might be useful to create a practical definition of systemic importance that will give supervisory authorities the possibility to apply their instruments to influence the relevant financial institutions. In this sense we can identify SIFIs by classifying their funding sources and measuring their contribution to systemic risk. The standard classification for identifying systemic importance (Thomson, 2009) is based on the size of the financial institution, its interconnectedness, the correlation between financial institutions' balance sheets, the concentration of financial institutions' activities, and the macrofinancial conditions and overall context (such as the political system and the structure of the financial industry and).

The reason for this classification is that ther are various factors that influence the systemic character of the institutions. First methods for identifying systemic importance were based on „Too-big-to-fail" theory and therefore on the size of the institutions, but this approach is inadequate for the current regulatory identification of SIFIs. The current crisis has shown that even smaller financial institutions can contribute significantly to the systemic risk if they are too interconnected financially within the sector or have the potential to trigger a systemic event in some other way. Even a relatively small bank can have such potential if it has a significant share of an important market segment (e.g. mortgages), because distress in such a bank can negatively influence the view on the whole segment. On the other hand, a large financial institution can act as a stabiliser of the financial sector thanks to its ability to absorb a large part of systemic risk. (Komárková, Z., Hausenblas, V., Frait, J. 2012)

2.2 Methods of identifying systemically important banks

The easiest way to assess systemic importance of banks might be purely judgement based methodology. The regulatory authority would take a look at the largest banking companies in terms of their size of the institution compared to domestic economy; significant crossborder activities that might make the

resolution of a bank difficult; their concetration in the banking system, where the financial services provided by an individual bank cannot be easily substituted; the correlation between banks portofolios and the inter-bank financing; and their reliance on short-term funding, particulary in foreign currencies. These banks then might be assessed as systemically important and be subject to further regulations. Adopting such a judgement based methodology for the regulatory authority might be attractive because of its flexibility to label any banks as systemically important.

However, in the absence of any quantitative analysis, this methodology may be criticized of being subjective, arbitrary, unpredictable and non-transparent. These weaknesses might be overcome by constructing simple indicators of systemic importance that would capture the different dimensions of risk, that the banks contribute to the system. The indicators would use accounting data from balance sheets of banks to serve as proxies for systemic risk such as size of the bank or inter-bank lending and deposit taking. These simple indicators are attractive because they are relatively easily adaptable for the use in regulatory policy, explainable to the public, financial institutions and legislative bodies and they are also intuitive. The downside of such simple methodology is that it might not capture the complex problem of systemic importance. Such simple accounting based indicators are backward looking and the approach they have towards systemic risk might be too simplistic.

Another option might be to implement a methodology that would use more forward looking indicators based on market data and more based in economic theory. In principle, these advanced indicators would measure systemic risk by relying on statistical techniques and econometric calculations using valuations from financial markets. These techniques would be used to gather the markets perception of the financial institutions' systemic importance. Such methodology might be more forward looking and founded in economic theory but also has some downside. The valuations of financial institutions might not be available for all of them in the financial markets. Also the measures of systemic importance

based on valuations on financial markets might be destorted by the explicit and implicit state guarantees. The anticipation of the future bail-outs will be reflected in the pricing of banks assets and debt which will in turn affect the market based methodology for assessing systemic importance. Also, depending on the set-up of the methodology and possible regulation the market participants have incentives to influence the indicators throught market manipulation. (Bengtsson, E., Holmberg, U. and Jönsson, K. (2013)

It is commonly recognized that systemic importance is derived from systemic risk, however there is no common agreement on how to measure systemic risk. The main reason for this is that the systemic risk is a complex phenomenon and spreads through various channels. (Bisias 2012)

One possibility is to measure the vulnerability of financial insitution to system-wide distress. That means that a calculation of impact of systemic shock on individual institutions is done. Examples include the Marginal Expected Shortfall (MES) of Acharya et al. (2010), which measures a financial institution's expected loss when the market falls below some predefined threshold over a given time horizon. Another example is the Systemic Risk Measures of Brownless and Engle (2011). It estimates the expected capital shortfall of a financial institution, conditional on a crisis occurring. Segoviano and Goodhart (2009) introduce a measure that captures dependencies among banks' probabilities of default through linear and non-linear dependencies between banks in the banking system as a whole. Adrian and Brunnermeier (2011) proposes a conditional Value-at-Risk (VaR) approach, that can be used to calculate the VaR of banks under the condition that the financial system is under stress . A final example is Brunnermeier, Gorton and Krishnamurthy (2010), who unlike the above methods include the liquidity position of banks to assess impact on system-wide net liquidity in systemic risk. Taken together, these methods are useful for understanding the vulnerability of a particular financial institution to systemic shocks, but they do not capture how distress in that institution impacts on the system.

Other possibility are the methods that capture how important a particular financial institution is for the system as a whole. These methods calculate the impact on the financial system in case a particular financial institution is in distress. For example, Acharya, Engle and Richardson's (2012) capital shortfall approach measures the maximum monetary loss of the system that can be expected to occur with some small probability, conditional on a particular financial institution being in a distressed state. Billio et al (2012) proposes a Granger causality test to examine whether the development of a bank's stock price may be useful in forecasting developments in another bank's share price. The existence of such a causality could be a sign that there is a connection between banks that can cause contagion. The more contagion a bank can cause, the more important the bank is. There are also other approaches that look into how individual institutions contribute to system-wide stress through network effects (Allen and Babus 2009) or various forms of interconnectedness and joint probabilities of default (Segioviano and Goodhart 2009).

With these various complex methods and on the other hand more simple indicator-based measurement methods as eg. the one proposed by BCBS 2011b, the regulatory authority is facing a task to balance the trade-offs between transparency, simplicity and predictability and more advanced approach, which might better capture the systemic risk, but with complexity and untransparency as a side effect.

2.3 Domestic systemic importance

BCBS has issued the rules for assessment methodology for global systemically important banks and their additional loss absorbency in 2011 (BCBS 2011b). The reason for adopting additional measures for G-SIBs was based on the negative externalities created by these banks which the regulatory policies did not fully address. The financial institutions maximise their private benefits and therefore might rationally choose outcomes that are optimal from the system-wide point of

view because they do not take into account these externalities. These negative externalities include the impact of the failure of large, interconnected global financial institutions that can send shocks through the financial system which, in turn, can harm the real economy. The moral hazard costs associated with direct support and implicit government guarantees may increase risk-taking, reduce market discipline, create competitive distortions, and further increase the probability of distress in the future. As a result, the costs associated with moral hazard add to any direct costs of support which might be laid on taxpayers. The additional requirement for G-SIBs, which applies above the Basel III requirements, is supposed to limit these cross-border negative externalities on the global financial system and economy associated with the most globally systemic banking institutions.

Similar externalities can apply at a domestic level. There are many banks that are not significant from an international perspective, but nevertheless could have an important impact on their domestic financial system and economy compared to non-systemic institutions. Some of these banks may have cross-border externalities, even if the effects are not global in nature. Similar to the case of G-SIBs, it was considered appropriate to review ways to address the externalities posed by D-SIBs.

In 2012 BCBS has published another set of rules recommendations concerning the assessment methodology for D-SIBs. This framework is supposed to be complementary to the regime applied for G-SIBs by focusing on the impact the failure or distress of banks will have on the domestic economy. It is supposed an assessment conducted by the national authorities, who are the most suitable for evaluating the impact of failure on local economy and financial system. Where the G-SIB approach is rather strict and prescriptive, the D-SIB approach allows for appropriate level of national discretion to accomodate the structural characteristics of domestic financial system, including the possibility for countries to go beyond the minimum D-SIB framework and impose additional

requirements based on the specific features of the country and its domestic banking sector.

The purpose of this paper is to adapt the D-SIB rules for the Czech banking sector and assess the systemic importance of domestic banks. The BCBS 2012 paper states 12 principles that should be followed when dealing with D-SIB. The principles 8-12 are dealing with the additional higher loss absorbency and therefore are not that relevant for this paper. Principles 1-7 focus on the assesment methodology and are stated as following:

„Principle 1: National authorities should establish a methodology for assessing the degree to which banks are systemically important in a domestic context.

Principle 2: The assessment methodology for a D-SIB should reflect the potential impact of, or externality imposed by, a bank's failure.

Principle 3: The reference system for assessing the impact of failure of a D-SIB should be the domestic economy.

Principle 4: Home authorities should assess banks for their degree of systemic importance at the consolidated group level, while host authorities should assess subsidiaries in their jurisdictions, consolidated to include any of their own downstream subsidiaries, for their degree of systemic importance.

Principle 5: The impact of a D-SIB's failure on the domestic economy should, in principle, be assessed having regard to bank-specific factors:

(a) Size;

(b) Interconnectedness;

(c) Substitutability/financial institution infrastructure (including considerations related to the concentrated nature of the banking sector); and

(d) Complexity (including the additional complexities from cross-border activity).

In addition, national authorities can consider other measures/data that would inform these bank-specific indicators within each of the above factors, such as size of the domestic economy.

Principle 6: National authorities should undertake regular assessments of the systemic importance of the banks in their jurisdictions to ensure that their assessment reflects the current state of the relevant financial systems and that the interval between D-SIB assessments not be significantly longer than the G-SIB assessment frequency.

Principle 7: National authorities should publicly disclose information that provides an outline of the methodology employed to assess the systemic importance of banks in their domestic economy.“ (BCBS 2012)

In line with these principles and adjusting the G-SIB assessment methodology, this paper tries to set-up a transparent suitable methodology to identify Czech systemically important banks using available data. In the next part the characteristics of Czech banking system are summarized and the part after introduces the methodology.

3 Czech banking system

Czech banking system is stable and profitable according to Czech National Bank (ČNB). The surplus of deposits over loans provides the banks with sufficient money reserve and makes the banks not dependent on foreign financing. The ratio of loans to deposits is around 80%, which is one of the lowest in European union. Stress tests conducted by ČNB show that Czech banking system is able to survive even very negative economic conditions. Czech banks have very good liquidity position with over 45% of client's deposits covered by liquid assets. Czech banks have sufficient capital buffer, with most of their capital consisting of Tier 1.

No Czech bank is globally systemically important according to FSB 2013, however some of them are subsidiaries of banks that are considered as G-SIB (eg. Komerční Banka and Unicredit Bank).

ČNB does not publish the list of domestic systemically important banks as of now (June 2014), however it states that additional capital buffer would be required for four banks initially, while the list can change in the future according to current situtation. The list of banks required to create additional capital buffers will be published by ČNB, when the legislative for the regulation of these banks will be implemented and applied. No higher loss absorbency are applied yet but ČNB states that the concerned systemically important banks are already fulfilling the potentional additional requirements.

4 Assessment methodology

This part describes the methodology used for assessment of systemic importance of banks in the Czech financial sector. Section 4.1 describes the indicator based measurement approach proposed by BCBS for identifying global systemically important banks and the suggestions for identifying the systemically important banks in on the level of states. Section 4.2 describes the individual categories that contribute to systemic importance of banks and also presents the indicators suggested by BCBS and the indicators that are used in this paper. Section 4.3 presents the calculation method used for identifying systemically important banks in this paper and section 4.4 describes the data used for the calculation.

4.1 BCBS approach

The BCBS proposes to use an indicator based measurement approach. The methodology for identifying G-SIB proposed by BCBS (2011) sets five categories of indicators which should capture different aspects of negative externalities that make banks critical for the stability of financial system. These are size, interconectedness, substitutability, complexity and global scope. BCBS sees the advantage of this multiple-indicator measurement method in its relative simplicity, its coverage of many dimensions of systemic importance and its robustness compared to model based methodologies and the methodologies that use only a small set of indicators. It is stressed in the report that no measurement approach can correctly and perfectly measure systemic importance. Therefore, the quantitative indicator based measurement approach can be complemented by qualitative information of the supervisory judgement. Although this supervisory judgement should be applied only in exceptional cases and be set under peer review.

The rules set for national authorities for identifying domestic systemically important banks are defined much more loosely by BCBS (2012). The national authorities are supposed to set their own methodology to assess which banks are systemically in domestic context. The methodology should reflect the potentional impact of bank's failure. The D-SIB methodology should be based on four indicator categories – size, interconectedness, complexity and substitutability. The global scope category is omitted because the reference system is the domestic economy. The national authorities are allowed to use other indicators that seem important with regard to specifics of domestic economy and financial sector.

The systemic importance score for each bank in the BCBS G-SIB methodology is calculated as following. Each of the categories of indicators is assigned total weight of 20%. Within each category the individual indicators are weighed equally. That is if there are two indicators each of them is assigned 10% weight for the total score, if there are three indicators each of them is assigned 6.67% weight.

For each particular indicator a score is calculated by dividing the individual bank amount by the sum of amounts of all banks in the sample. The total score for each bank is calculated by summing the weighed indicators. (BCBS 2011b)

In this paper the general BCBS systemically important bank identification approach is followed. The guidelines and categories of indicators suggested are used as in G-SIB methodology (excluding global scope), however the individual indicators are different. The G-SIB approach requires large amount of data to determine the systemic importance of banks. Most of the necessary figures are only revealed to the regulatory authorities. (Brämer, P., Gischer, H. 2011) Thus the individual indicators had to be adapted and chosen with respect to data availabity and transparentness of the methodology. Also the calculation method has been slightly modified. The categories that reflect the dimensions of systemic importance and the choice of individual indicators are presented in the next section.

4.2 Categories of indicators

4.2.1 Size

The first and most obvious category for identifying a bank as a SIFI is its size. It represents the too-big-to-fail problem. The larger the bank and its activities, the higher the damage caused by its failure. In case of failure of a relatively large bank it would be more difficult for other banks to replace its services and activities and thus cause distress in the financial markets both in liquidity and service provision. Furthermore a relatively large bank is likely to be well known and thus its failure may damage the confidence in the whole financial and banking system. Drehmann and Tarashev (2011) show that size is the most important in determining systemic importance. The size of a bank can be therefore identified as a key category for its systemical importance.

BCBS includes only one indicator in this category – total exposures. However the indicator total exposures defined in Basel III text (BCBS 251) as exposure measurement requires both on-balance and off balance items, which can be impractical for authorities to use in the measurement. Instead easily observable and usable proxy from the balance sheet is used in this paper – total assets.

4.2.2 Interconectedness

Financial distress in one bank can cause problems in other banks because of their contractual obligations and thus affect the stability of the whole banking system. The troubled bank might not be able to repay its interbank liabilities which increases the possibility of distress in other bank institutions. Strong interconectedness between banks causes growth in systemic risk and reduces the amount of provided financial services.

BCBS methodology uses three indicators for this category – intra-financial system assets, intra-financial system liabilities and wholesale funding ratio. The first two indicators do not measure only the volumes of deposits and loans between

financial institutions, but the volumes of net mark to market reverse repurchase agreements, securities and OTC derivatives traded with other financial institutions. BCBS also uses the wholesale funding ratio to consider the degree to which the bank finances itself from other financial institutions as a further indicator of interconectedness. The institutions with high wholesale funding ratio ie whose illiquid assets are financed with short-term liabilities were quick to spread contagion into financial system in case of market run on them during recent crisis. (BCBS 2011b). Due to nonsufficient data availability and the reasons given in Brämer and Gischer (2013), who consider the official indicator not to be able to distinguish between long-term and short-term wholesale funding and are also sceptical about retail funding enhancing financial stability, the wholesale funding ratio indicator is omitted in this paper. Also the first two indicators had to be simplified due to data availability. The indicators used in this methodology to reflect bank interconectedness are loans and advances to banks and deposits from banks.

4.2.3 Substitutability

The substitutability of bank's services is important in two aspects. Firstly the bank that holds a significant share of market or significant share of provision of particular services e.g. payments system or mortgage market is less likely to be replaced by another institution in case of its failure. The higher the substitutability of bank's services by other financial institutions the lower is its systemic impact. The greater the role of a bank as a service provider in a particular part of the market the higher the distress caused by its failure in terms of gaps of service providing and lower market and infrastructure liquidity. Secondly the substitutability of a bank is important from the point of view of the bank as a customer service provider. In case of failure of a bank with high market share the costs are higher for the customers to find an alternative for providing the service.

The BCBS indicators for substitutability category are assets under custody, payments cleared and settled throught the financial system and values of underwritten transactions in debt and equity markets. Again these indicators were hard to obtain for the use in this paper's methodology, so an approach similar to Brämer and Gischer (2013) was used. In their paper they suggest to use ‚non-substitutability' category. Where in the official BCBS methodology this category is supposed to reflect the importance of a bank as service provider to other financial institutions, their approach should express the relevance of the bank to customers outside the financial industry who have no direct access to money market or capital market funding instruments. A high share of loans to these customers indicate low substitutability of the bank and higher risk because other sources of funding would be harder to get. In this paper loans to nonbanks are used as an indicator to reflect this dimension of systemic importance. Customer deposits are used as a second indicator in this category to reflect the main purpose of banks in Czech republic ie. deposit taking institutions. The higher the share of customer deposits the harder it would be to find an alternative for the customers.

4.2.4 Complexity

BCBS suggests that the more complex a bank is in terms of its business and operations structure, the higher the costs and time needed to resolve the bank. This category is supposed to capture the „too-complex-to-fail" dimension of systemic importance (Herring 2003).

The BCBS indicators for complexity are OTC derivatives notional value, level 3 assets and trading book value and ready for sale value. These indicators are illustrating the number of complex agreements that the bank has created with different customers, which increase the costs and time needed to resolve the bank. Generally the more complex assets the bank holds the higher the risk of financial contagion in the system. The complexity of these agreements could also eventually be complication in case of financial liquidation of the bank.

As Brämer and Gischer (2013) suggest the use of non-centrally cleared OTC derivatives and non-clearly priced level 3 assets are not in line with the purpose of transparent methodology and also not easily usable due to data availability. Instead, we use derivatives which is an indicator easily accesible from Bankscope database and captures all the derivatives in banks portfolio. Trading securities and available for sale securities are also used because holding of these securities can cause spillover effects if the bank holding them faces stress and is forced to fire sales. In turn, market prices of these securities would decline and other banks would be forced to write down their holdings of these securities (BCBS 2011b).

Table 1 presents the indicators used in this paper to identify Czech systemic important banks. Each of the categories has equal weight 25% in this table and the individual indicators are weighed equally within the categories.

Table 1 Categories and indicators of systemic importance

Category	Indicator	Indicator weighing
Size	Total assets	25%
Interconectedness	Loans and advances to banks	12.5%
	Deposits from banks	12.5%
Substitutability	Loans to nonbanks	8.33%
	Customer deposits	12.5%
Complexity	Trading securities	8.33%
	Available for sale securities	8.33%
	Derivatives	8.33%

Source: Author, BCBS (2011)

4.3 Calculation method

The total score of systemic importance of domestic banks given the equal weights of all categories is calculated as follows:

$$SCORE_{ij} = \frac{ASSETS_{ij}}{\sum_i^n ASSETS_{ij}}\left(\frac{1}{4}\right) + \frac{LOANSB_{ij}}{\sum_i^n LOANSB_{ij}}\left(\frac{1}{8}\right) + \frac{DEPB_{ij}}{\sum_i^n DEPB_{ij}}\left(\frac{1}{8}\right) + \frac{LOANSNB_{ij}}{\sum_i^n LOANSNB_{ij}}\left(\frac{1}{8}\right) + \frac{DEPCUST_{ij}}{\sum_i^n DEPCUST_{ij}}\left(\frac{1}{8}\right) + \frac{TRADSEC_{ij}}{\sum_i^n TRADSEC_{ij}}\left(\frac{1}{12}\right) + \frac{AFSSEC_{ij}}{\sum_i^n AFSSEC_{ij}}\left(\frac{1}{12}\right) + \frac{DERIVATIVES_{ij}}{\sum_i^n DERIVATIVES_{ij}}\left(\frac{1}{12}\right)$$

Where

i	individual bank,
n	the number of banks in period j
$ASSETS$	total assets
$LOANSB$	loans and advances to banks
$DEPB$	deposits from banks
$LOANSNB$	loans to nonbanks
$DEPCUST$	customer deposits
$TRADSEC$	trading securities
$AFSSEC$	available for sale securities

The BCBS calculation method sums all the categories without multiplying them by their respective weights, however the individual indicators are still weighed equally within the categories. By calculating the score like this the categories contribute 25% (20% in case of 5 categories) to the total score, but the the individual bank scores lies between 0 and 4. In this paper each indicator is weighed by its own weight as given in the Table 1 and then summed. In this way it is ensured that each score lies between 0 and 1 and therefore represents bank's share of the total system.

4.4 Data description

The data for the analysis were taken from Bankscope database (version 12/2013). Bankscope is a database containing global data of bank's financial statements, ratings and intelligence. It was chosen for this analysis becauses it allows to comprehensively find data on banks according to countries and filter needed figures with its own software. Bankscope is a commercial database but was available free for study purposes thanks to university.

The sample contains data from 31 banks and banking institutions collected as end of year figures for the period 2008-2012 as 2012 was the last year for which all of the data were available. The start year 2008 was chosen as the year in which the recent financial crisis peaked and therefore a good starting point for the analysis. 5 year period should be sufficient for the present view of systemic importance of banks, although the present view in this case is the one of the end of year 2012, so the results are outdated. This is not a problem as this paper does not serve as a foundation for regulation of Czech banks but as a proposal of method of identifying their systemic importance. More on the availability of data is described in section 5.3.

5 Results

Part 5.1 presents the results of the assessment of systemic importance of Czech banks using the indicator based measurement, part 5.2 concerns the additional loss absorbency, which is the reason why the systemic importance of banks is computed and part 5.3 describes the problem of data availability.

5.1 Results of the indicator-based measurement

Table 2 shows the total score and the scores in the individual categories of systemic importance for the ten institutions that achieved the highest score. The scores for the banks are computed for the data from 2008 – 2012. Scores for the rest of the banks in the sample are summed at the bottom of the table.

Table 2 Systemic importance of Czech banks

Rank	BANK NAME	SIZE	INTERCON-NECTEDNESS	SUBSTITUT-ABILITY	COMPLEXITY	SCORE
1	**Česká Spořitelna**	0,2149	0,1930	0,2133	0,2037	**0,2062**
2	**ČSOB**	0,2160	0,0766	0,2076	0,3098	**0,2025**
3	**Komerční Banka**	0,1768	0,1233	0,1872	0,2698	**0,1892**
4	**Unicredit Bank**	0,0691	0,1144	0,0663	0,0910	**0,0852**
5	**Raiffeisenbank**	0,0476	0,0701	0,0549	0,0273	**0,0500**
6	**Hypoteční banka**	0,0410	0,1205	0,0308	0,0002	**0,0481**
7	**GE Money Bank**	0,0321	0,0179	0,0419	0,0074	**0,0248**
8	**ČMZRB***	0,0177	0,0522	0,0080	0,0178	**0,0239**
9	**SSČS***	0,0248	0,0417	0,0216	0,0038	**0,0230**
10	**ČMSS***	0,0318	0,0015	0,0479	0,0096	**0,0227**
	OTHER	0,1280	0,1888	0,1204	0,0597	**0,1242**

* ČMZRB - Českomoravská Záruční a Rozvojová Banka, SSČS – Stavební Spořitelna České Spořitelny, ČMSS – Českomoravská Stavební Spořitelna

Source: author's calculations

The results show that the three largest banks in terms of size are also the most systemically important as they capture almost 60% of systemic importance in the whole system. If we add the bank with fourth highest systemic score then these four banks capture almost 70% of systemic risk in the whole system. ČNB does not specifically name banks that are considered systemically important by its calculations, but the Report on financial stability (ČNB 2014) states that at the time four banks are considered to be systemically important enough to be subject to additional capital requirements. This fact suggests that the threshold for a bank to be systemically important should be somewhere above 0.05 in this methodology. Skořepa and Seidler (2013) propose a transparent method to use q times the average score in the sample as a threshold. The value of q should be chosen by regulatory authority depending how strict the D-SIB identification is supposed to be. In their article the value used is 2. Threshold value using this method for our sample is 0.0645. This value seems to be acceptable as it sets four banks as being systemically important which corresponds with report of ČNB. The results show that the highest systemic importance has Česká Spořitelna followed by Československá Obchodní Banka (ČSOB) and Komerční Banka. Each of these institutions captures around 20% of the whole systemic risk. These banks should certainly considered to be systemically important. Unicredit Bank on the fourth position with its 8,52% share does not seem to be as important player in the system as the big three. The rest of the institutions in the sample score under or equal to 0.05.

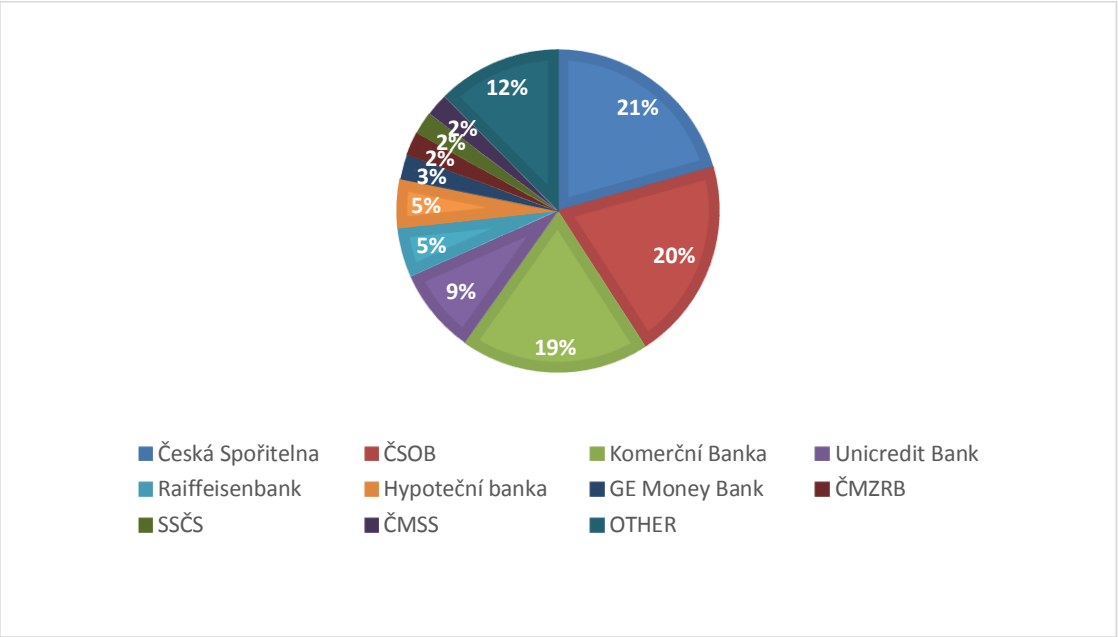

Figure 1 Share of the systemic importance

Source: Author's computations

When assessing the systemic importance of banks the easiest method might be to just look at their size in terms of value of assets on their balance sheet and consider the largest banks to be most systemically important. The calculated results confirm that the size dimension is good estimate of bank's systemic importance in Czech Republic. The ranking of the institutions according to their calculated scores follows almost exactly their ranking according to their size with some small exceptions. The correlation coefficient of total assets and the systemic score is approximately 0.995 which is fairly high. However the category in this analysis consists only of one indicator - total assets instead of suggested total exposures, so the importance of this category might be lower. The correlation coefficients for interconnectedness, substitutability and complexity are 0.847, 0.989 and 0.965 respectively. In the interconnectedness category the highest score belongs to Česká Spořitelna. Second most systemically important bank ČSOB scores fairly low in this category with 0.0766 score exceeded even by sixth placed Hypoteční banka. If we were to rank the systemic importance only according to interconnectedness, Hypoteční banka would be included in the

"Big 4" instead of ČSOB. ČSOB is a major shareholder of Hypoteční Banka and if we were to consider them as one institution and sum their scores for the interconnectedness category, the value is even a bit higher than the one of Česká Spořitelna. Hypoteční Banka is a mortgage bank meaning it has no deposits from customer (0 in customer deposits indicator), but has a fairly large share of deposits from banks (second highest after Česká Spořitelna). The substitutability category ranking is also very similar to the total score. In complexity ČSOB holds the first position with its 30% share of total score followed by Komerční Banka and Česká Spořitelna.

These are scores averaged for the whole period of 2008-2012. They are useful to have an overview for the whole period and assess which institutions have been systemically important over the five years. A recent overlook might be more useful for regulatory purposes because the assessment of systemic importance should be done regularly to ensure that the regulatory authorities have the assessment that reflects the most current state of the financial system (Principle 6, BCBS 2012). Table 3 shows the scores and categories of systemic importance in 2012 (the latest available data for this analysis).

Table 3 Systemic importance of Czech banks in 2012

Rank	BANK NAME	SIZE	INTERCON-NECTEDNESS	SUBSTITUT-ABILITY	COMPLEXITY	SCORE
1	**Česká Spořitelna**	0,2024	0,1815	0,1967	0,2214	**0,2005**
2	**Komerční Banka**	0,1730	0,1454	0,1847	0,2956	**0,1997**
3	**ČSOB**	0,2060	0,0798	0,2046	0,2395	**0,1825**
4	**Unicredit Bank**	0,0701	0,1208	0,0655	0,0840	**0,0851**
5	**Hypoteční banka**	0,0442	0,1653	0,0340	0,0000	**0,0609**
6	**Raiffeisenbank**	0,0434	0,0382	0,0519	0,0309	**0,0411**
7	**ČMSS**	0,0371	0,0037	0,0572	0,0098	**0,0269**
8	**SSČS**	0,0227	0,0576	0,0175	0,0001	**0,0245**
9	**J&T Banka**	0,0194	0,0299	0,0183	0,0266	**0,0235**
10	**PPF banka**	0,0169	0,0340	0,0105	0,0311	**0,0231**
	OTHER	0,1466	0,1737	0,1406	0,0979	**0,1397**

Source: Author's computations

The results for 2012 are not very different from the averaged results for 2008-2012. There are some changes in ranking but the general outcome is the same. The same three big banks capture almost 60% of the system with their each of their scores around 20%. With the addition of fourth bank its above 66%. The most systemic important bank is Česká Spořitelna followed by Komeční Banka and ČSOB. The size dimension does not rank the three highest scoring banks properly. ČSOB with highest share of total assets in the system (20,6%) being the third in systemic importance score. Komerční Banka scores above ČSOB mainly because of its high score in complexity and Česká Spořitelna outweighs ČSOB significantly in interconnectedness. When setting the score for a bank to be systemically important at two times the average score in the sample we get the threshold value 0.0645. Hypoteční Banka with its score 0.0609 is really close to this value and might be taken into consideration by regulatory authorities.

It might be useful to observe the changes of systemic score in time. Figure 2 shows the development of systemic scores of six banks with highest systemic importance over 2008-2012.

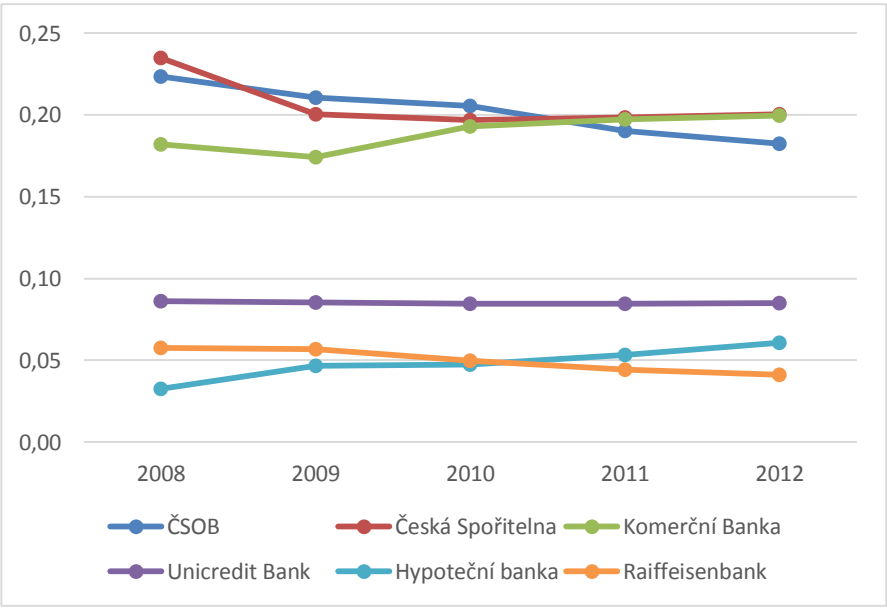

Figure 2 Domestic systemic importance over 2008-2012

Source: Author's computations

As Figure 2 shows there have been no significant changes in the scores of the six largest banks during this period. Systemic importance of Česká spořitelna has dropped from 0.2348 to 0.2005 over the five years. ČSOB while having second highest score in 2008 has been also steadily declining over the period from 0.2235 to 0.1825. In years 2009 and 2010 ČSOB has even scored the highest but in 2012 it was the third highest score. Komerční Bn anka on the other hand has been raising its systemic importance over the period. In 2008 Komerční Banka captured 5% less of the whole systemic risk than Česká Spořitelna while in 2010 its score was almost the same. The fourth highest scoring bank – Unicredit has remained on almost the same level around 0.085 over the period. Raiffeisen bank shows slowly declining trend in its score which is around 0.05 over the period. Hypoteční Banka on the other shows rising trend and in 2012 its score almost reaches the threshold value for it to be taken as systemically important. The average yearly rise in its systemic score over the five years is 0.0071 and if this holds in 2013 it should have systemic score above the threshold value of 0.0645.

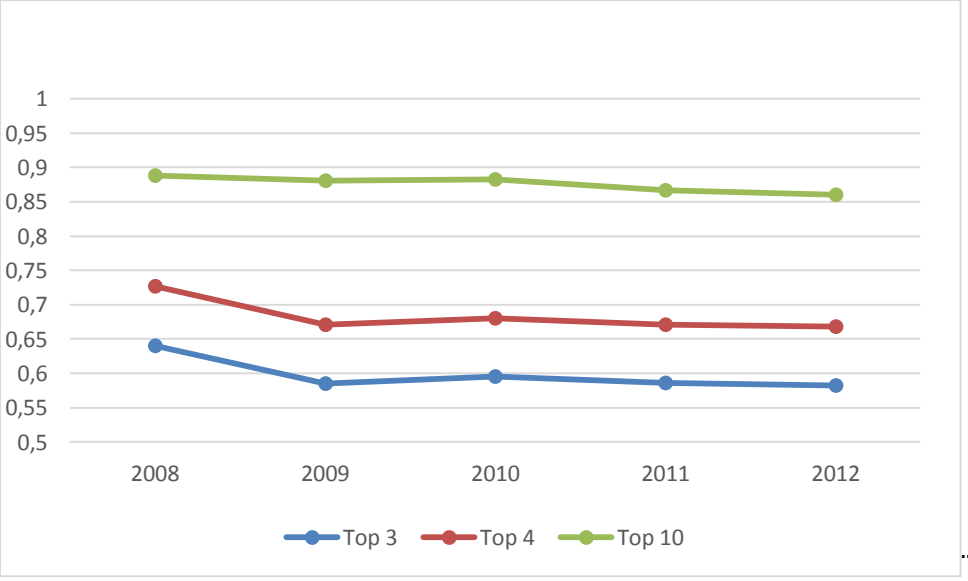

Figure 3 Domestic systemic importance of large Czech banks

Source: Author's computations

Figure 3 shows the share of domestic systemic importance of the top 3, 4 and 10 institutions yearly. We can find that although the major banks still dominate the systemic importance their share of it keeps slightly decreasing. Over the five years period it is around 5% decrease both for top 3 and top 4 banks and 2.5% for the top 10 banks. The decreasing trend in systemic importance of major banks shows that domestic systemic importance is distributed among the system more evenly. This implies that if the trend continues more banks might be considered systemically important.

5.2 Bucketing approach

The whole purpose of identifying domestic systemically important banks is to assess their contribution to the systemic risk in the domestic financial sector and provide the national authority with information on their further regulation. Because the failure of D-SIBs might trigger systemic crisis or endanger the functionality of the financial system the goal of the regulation is to reduce the probability of such failure by increasing their loss absorbency. The main tool of the regulation is the additional loss absorbency rule which allows the regulatory authority to require banks to hold additional percentage of Tier 1 capital to risk-weighted assets. In the G-SIB methodology the additional capital buffers are dealt with by "bucketing approach". The G-SIBs are grouped into different categories according to their systemic importance based on the indicator-based measurement approach, with varying levels of additional loss absorbency requirements applied to different buckets. This approach is supposed to be followed also in the case of D-SIBs and domestic regulation. The national authority should sort the domestic systemically important banks in to buckets according to their scores.

The results of the indicator based method proposed in this paper for Czech Republic have shown that there are four systemically important banks in the financial sector. Three of them – Česká Spořitelna, Komerční Banka and ČSOB

represent each around 20% of the systemic risk and therefore should be put in the same bucket. The fourth bank assessed as systemically important Unicredit Bank represents around 8.5% of the total systemic risk which is less than a half of the systemic risk of each of the "Big 3". Unicredit Bank should be assigned to lower bucket. In the G-SIB methodology BCBS also proposes to create another bucket with the highest additional capital requiremeent, which is to be left empty as an incentive for the banks not to raise their systemic importance. Table 4 shows the proposed buckets for additional capital requirements for Czech banks. The exact values of the additional capital requirements are to be set by regulatory authority and therefore are left out in table 4 with highest loss absorbency being assigned bucket A, which the bucket that would be initially left empty. Because the relatively high difference – more than 10% of total systemic risk - between scores of banks in B bucket and C bucket, another bucket might be inserted inbetween when considering the actual values of additional capital requirement.

Table 4 Buckets of Czech D-SIBS

Bucket	Banks
A	*empty*
B	Česká Spořitelna Komerční Banka ČSOB
C	Unicredit Bank

Source: Author

5.3 Data availability

The downside of simple indicator-based measurement approach is indeed its simplicity because the results are not very robust. Even when using simple indicators the robustness of the results can be improved by using multiple indicators. The BCBS G-SIB methodology uses 12 indicators while some of them are more composite like total exposures. Skořepa and Seidler (2013) in their work on identification of Czech D-SIB use 20 indicators. In this paper the

methodology is based on 8 indicators which suggests that the results are not very robust. The main reason of such a small number of indicators is the problem of availability of data needed for more robust measurement. Some proposed indicators such as total exposures are impossible to collect for public. The calculation of total exposures defined as exposure measure in the leverage ratio in the Basel III text requires both on-balance sheet and off-balance sheet items which are very difficult to obtain. However Basel III text states: „Public disclosure by banks of their Basel III leverage ratio starts on 1 January 2015". So for future measurements the indicator for size category should be easily publicly accessible. Another example is the indicator payments settled and cleared through payment systems proposed by BCBS. Publicly available statistics for CERTIS (Czech Express Real Time Interbank Gross Settlement system) provided by ČNB show only the aggregated data for the whole system therefore it is not possible to obtain the data for individual banks. Some of the data publicly disclosed by the banks are only broad aggregates and are not detailed enough for the purposes of analysis of systemic risk. Cerutti, E., Claessens, S. and McGuire, P. (2011) state this problem arises also when assessing the G-SIB, where mainly the data are not internationally coordinated and also most of the publicly available data is insufficient or provided as aggregates.

Bankscope database was used as a source of data in this paper. Its advantage is that the data are taken from one source that collects them from the individual banks' statements and offers them in unified form. This allows for evasion of the method where the figures would be searched in individual bank's statements which are publicly reported more less differently and make it harder for the comparison of corresponding figures. The downside of the database is that not all indicators proposed by BCBS could be found and satisfactory proxies for them had to be used as described in section 4.2. Another problem was that the available version of Bankscope database did not supply the most recent data i.e. end of year 2013 and so the results of the measurement method are outdated.

The aim of this paper was to develop a transparent and simple methodology using publicly available data. Although the results of the measurement are not robust and recent, they identify the systemically important banks in Czech Republic. The four banks identified as domestic systemically important in this paper correspond with banks that would be identified as such by simple judgement and also the ČNB states in its Financial and Stability Report 2013/2014 that four banks are identified by its methods as D-SIB. The aim of proposing the methodology was fulfilled and the robustness of the results might be improved when the quality and availability of needed data is improved by e.g. legislative norms.

6 Conclusion

This paper summarizes methods for identifying systematically important institutions and introduces methodology to assess the systemic importance of Czech banks based on the official BCBS approach to define global systemically important banks.

First the definition of systemic importance and the various theoretical methods for measurement of systemic risk are summarized. Then according to the BCBS approach for identifying global systemically important banks an assessment methodology for Czech systemically is presented. The rules set by BCBS for identifying domestic systemically important banks allow for certain amount of national discretion for the domestic regulatory authority and aim of the paper is to set up a methodology which is usable for Czech financial sector. In line with the BCBS approach the indicator-based measurement methodology is used. The method measures the systemic importance of banks in terms of their size, interconnectedness, substitutability and complexity and uses balance sheet indicators. Each category is presented by several indicators in the BCBS approach. The indicators used for identifying Czech systemically important banks are adjusted from the official approach due to the availability of needed data and in order to present a simple and transparent methodology.

The proposed approach is used to calculate specific systemic importance of Czech banks based on the end of year data from the period of 2008-2012. Four banks – Česká Spořitelna, ČSOB, Komerční Banka and Unicredit banks are identified as domestic systemically important. The former three are found to capture around 20% of systemic important each while the last one under 10%. These systemic scores are fairly stable over time. The simple bucketing approach which is used

as a tool for higher loss absorbency in the regulation of systemically important banks is then proposed.

Limitations of this study are mainly data related. The publicly available banking data are not sufficient for proper analysis. The calculated results are based on a small set of indicators which on one hand allows the method to be simple and transparent but on the other hand the problematic of systemic importance is so complex that they might not capture the problem with enough complexity and robustness.

Bibliography

Adrian, T. and Brunnermeier, M. (2010): "CoVaR", Staff Report No. 348, Federal Reserve Bank of New York.

Acharya, V., Engle, R. and Richardson, M. (2012): "Capital Shortfall: A New Approach to Ranking and Regulating Systemic Risks", American Economic Review, Vol. 102, p. 59-64.

Acharya, V., Pedersen, L., Philippon, T. and Richardson, M. (2010): "Measuring Systemic Risk", Working Paper, New York University.

Allen, F., Babus, A. and Carletti, E. (2009): "Financial Crises: Theory and Evidence", Annual Review of Financial Economics, Annual Reviews, vol. 1(1), pages 97-116, November.

BCBS (2011b): "Global Systemically Important Banks: Assessment Methodology and the Additional Loss Absorbency Requirement, Basel Committee on Banking Supervision", November 2011.

BCBS (2012): "A Framework for Dealing with Domestic Systemically Important Banks", Basel Committee on BankingS upervision, October 2012.

Bengtsson, E., Holmberg, U. and Jönsson, K. (2013): "Identifying systemically-important banks in Sweden – what can quantitative indicators show us?" Sveriges Riksbank Economic Review 2013:2

Billio, M., Getmansky, M., Lo, A. W., Pelizzon, L. (2012): "Econometric Measures of Systemic Risk in the Finance and Insurance Sectors", Journal of Financial Economics, Vol. 104, p. 535-559.

Bibliography

Bisias, D., Flood, M., Lo, A. and Valavanis, S. (2012): "A Survey of Systemic Risk Analytics", Working Paper No. 0001, Office of Financial Research, US Department of the Treasury.

Brämer, P., Gischer, H. (2011): "Domestic Systemically Important Banks: An Indicator-Based Measurement Approach for the Australian Banking System", FEMM Working Paper No.3/2012, Otto-von-Guericke University of Magdeburg.

Brownless, C. and Engle, R. (2011): "Volatility, Correlation and Tails for Systemic Risk Measurement", Working Paper, NYU Department of Finance.

Brunnermeier, M. K.,Gorton, G. and Krishnamurthy, A. (2010): "Risk Topography", Working Paper, Princeton University.

Cerutti, E., Claessens, S. and McGuire, P. (2011): "Systemic Risks in Global Banking: What Available Data Can Tell Us and What More Data are Needed?" , IMF Working Papers, Vol. , pp. 1-26, 2011

ČNB (2014) "Zpráva o finanční stabilitě 2013/2014", Financial Stability Report, Czech National Bank

Drehmann, M., Tarashev, N. (2011): "Systemic Importance: Some Simple Indicators", BIS Quarterly Review, March.

Financial Stability Board (2013): "2013 update of group of global systemically important banks (G-SIBs) "

Herring, R. (2013): "International financial conglomerates: implications for bank insolvency regimes," in Market Discipline and Banking: Theory and Evidence, G. G. Kaufman, Ed., pp. 99–129, Elsevier, Oxford, UK,

Komárková, Z., Hausenblas, V., Frait, J. (2012): "How to Identify Systemically Important Financial Institutions", Financial Stability Report 2011/2012, Czech National Bank, pp. 100–111

Segoviano, M. and Goodhart, C. (2009): "Banking stability measures", Discussion Paper No. 627. Financial Markets Group, London School of Economics and Political Science.

Skořepa, M. and Seidler, J. (2013): "An Additional Capital Requirement Based on the Domestic Systemic Importance of a Bank." Financial Stability Report 2012/2013, Czech National Bank, pp. 96–102

Thomson, J. B. (2009): "On Systemically Important Financial Institutions and Progressive Systemic Mitigation." Federal Reserve Bank of Cleveland Policy Discussion Paper No. 27.